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Draft Multi-Area Field Sampling Plan

Allied Paper, Inc./Portage Creek/ Kalamazoo River Superfund Site

*OU-4: Emergency Action at the 12th Street Landfill
Former Powerhouse Discharge Channel*

Plainwell, Michigan

Revision 1
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Acronyms and Abbreviations

µg/L	micrograms per liter
µg/kg	micrograms per kilogram
AA	atomic absorption
ARAR	Applicable Relevant and Appropriate Requirements
ASTM	American Society for Testing and Materials
BFB	p-bromofluorobenzene
BNA	base-neutral-acid extractables
CCB	continuing calibration blank
CCC	calibration check compound
CCV	continuing calibration verification
CD	Consent Decree
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COC	Chain-of-Custody
COPC	constituent of potential concern
CVAA	cold vapor atomic absorption
DFTPP	decafluorotriphenylphosphine
DI	deionized
DO	dissolved oxygen
DQI	data quality indicators
DQO	Data Quality Objective
ECD	electron capture detector
EDD	electronic data deliverable
Eh	redox
FB	field blank
FS	Feasibility Study
FSP	Field Sampling Plan
GC/MS	gas chromatograph/mass spectrophotometer
HSP	Health and Safety Plan
ICB	initial calibration blank
ICP	inductively coupled plasma

ICPMS	inductively coupled plasma mass spectroscopy
ICS	interface check samples
ICV	initial calibration verification
IDW	investigation-derived waste
kg	kilogram
KRSG	Kalamazoo River Study Group
L	liter
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LRA	linear range analysis
MDEQ	Michigan Department of Environmental Quality
MDL	Method Detection Limit
MS	matrix spike
MS/MSD	matrix spike/matrix spike duplicate
MSD	matrix spike duplicate
NCP	National Contingency Plan
NIST	National Institute of Standards and Technology
NTU	nephelometric turbidity unit
OSC	On-Site Coordinator
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
pH	negative logarithm (base 10) of hydrogen ion activity
PID	photoionization detector
PQO	Project Quality Objective
POTW	publicly-owned treatment works
PM	Project Manager
QA	quality assurance
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
QC	quality control
QL	Quantitation Limit
RASs	routine analytical services
RD/RA	Remedial Design/Remedial Action
RF	response factor

RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPD	relative percent difference
RL	reporting limit
RPM	Remedial Project Manager
RSD	relative standard deviation
RT	retention time
SAP	Sampling and Analysis Plan
SAS	special analytical services
SOP	standard operating procedure
SOW	Statement of Work
SPCC	system performance check compound
SRI/FS	Supplemental Remedial Investigation/Feasibility Study
SRM	standard reference material
SW846	Test Methods for Evaluating Solid Waste, 1996
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TCRA	Time-Critical Removal Action
TEMP	temperature
TB	trip blank
TSS	Total suspended solids
U.S. EPA	United States Environmental Protection Agency
VOC	volatile organic compound
WATS	Weyerhaeuser Analytical Testing Services

Section 1

Introduction

1.1 Background

Weyerhaeuser Company (Weyerhaeuser) was identified as a Potentially Responsible Party (PRP) for the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund site (Site) in a General Notice letter dated April 8, 2004, that was received by Weyerhaeuser and two other PRPs. Concurrently, Weyerhaeuser was negotiating a Consent Decree (CD) to undertake specific activities on the former Plainwell Mill and 12th Street Landfill sites. On February 22, 2005, Weyerhaeuser entered into a CD with the United States Environmental Protection Agency (U.S. EPA), for the Design and Implementation of Certain Response Activities at the 12th Street Landfill site (Operable Unit No. 4) and the Plainwell Mill site (Operable Unit No. 7). Both sites are part of the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund site (Figure 1-1), which is located in southwestern Michigan. A Statement of Work (SOW) for the Remedial Design/Remedial Action (RD/RA) at the 12th Street Landfill site was attached to the CD. A SOW for the Remedial Investigation/Feasibility Study (RI/FS) at the Plainwell Mill site was subsequently issued by the U.S. EPA, with an effective date of August 17, 2006.

In late February, 2007, the U.S. EPA authorized a Time-Critical Removal Action (TCRA) to remove polychlorinated biphenyl (PCB)-contaminated sediment in the former Plainwell Impoundment (a section of Operable Unit No. 5 of the Allied Paper/Portage Creek/Kalamazoo River Superfund Site). This work was subsequently implemented through an administrative settlement agreement and Order on Consent for Removal Action (V-W-07-C-8-63). As part of the TCRA, the earthen section of the Plainwell Dam will be removed and the Kalamazoo River will be rerouted through the former powerhouse channel. The 12th Street Landfill abuts the river and is located directly downstream of the earthen section of the Plainwell Dam. The Plainwell Mill also abuts the Kalamazoo River and PCB containing materials have been documented along the river bank at the Mill. The change in the Kalamazoo River channel will result in an increased river gradient and higher velocities upstream and along the rerouted channel (Syed, et al., 2004 and Robert, et al., 2004). The modified river flow is expected to mobilize residuals currently present in the powerhouse channel downstream and to erode bank material in the area of the Mill. Thus, the TCRA scope of activities are actions or occurrences which threaten releases of Waste Material (as defined in the CD) from both the 12th Street Landfill and the Plainwell Mill property. Since any such release may present an immediate threat to public health or welfare of the environment, Weyerhaeuser has been authorized to conduct several emergency response actions in conjunction with completing the required work under the CD.

The U.S. EPA requires that all environmental monitoring and measurement efforts mandated or supported by the U.S. EPA participate in a centrally managed quality assurance program. Any party generating data under this program has the responsibility to implement minimum procedures to ensure that the precision, accuracy, completeness, and representativeness of the data are known and documented. To ensure that the responsibility is met uniformly, a written Quality Assurance Project Plan (QAPP) and associated Field Sampling Plan (FSP) must be prepared for each project. A Multi-Area QAPP for the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund site has been submitted for review under separate cover. It has been prepared to support field activities by describing specific protocols that will be followed for sampling, sample handling and storage, chain-of-custody, and laboratory analysis for multiple areas of the Site. The Multi-Area QAPP also defines objectives, organization, functional activities, and specific quality assurance (QA) and quality control (QC) activities associated with implementing the Emergency Response activities in the former Powerhouse Discharge Channel. QAPP amendments will be submitted to supplement the current QAPP as additional work activities are authorized and defined.

This associated Multi-Area FSP establishes sample collection and field monitoring methods and procedures to be followed to ensure that sampling and investigatory activities at the Site are conducted in a consistent manner and in accordance with technically acceptable protocols. The objective of the FSP is to facilitate the collection of environmental monitoring data that meets Data Quality Objectives (DQOs) established in the Multi-Area QAPP (RMT, 2007a). This FSP will be modified in the future as other sampling programs are developed for Operable Units 04 and 07 as well as other areas of the Site as appropriate.

1.2 Document Organization

This FSP was prepared to establish Standard Operating Procedures (SOPs) for environmental monitoring activities expected or likely to be conducted for purposes of completing currently planned activities associated with the emergency response activities at the 12th Street Landfill site. Additional SOPs will be submitted as work areas are added or work tasks are modified. SOPs developed as components of amended scope document will become common to all sampling activities of the same type (*e.g.*, sediment core collection).

As additional work plans are prepared, it is anticipated that they will be incorporated as additional addenda to this document, referencing a combination of the same SOPs, amended SOPs, or additional SOPs. If additional SOPs are required, they will be added to Appendix A. If modified SOPs are required, they will replace existing SOPs in this document. Specific addenda will be provided as stand-alone documents.

1.3 Project Setting

The 12th Street Landfill and Plainwell Mill sites are located in Allegan County, Michigan (Figure 1-2). The 12th Street Landfill is located in Otsego Township (Section 24, Township 1N, Range 12W), and the

Plainwell Mill is located in the City of Plainwell (Section 30, Township 1N, Range 11W). Both sites are located adjacent to the Kalamazoo River, with the 12th Street Landfill located approximately 1½ miles northwest and downstream of the Plainwell Mill site. The 12th Street Landfill site is comprised of approximately 6.5 acres and is situated on roughly a 24-acre property that is bordered to the east by woodlands and a former hydroelectric powerhouse discharge channel on the Kalamazoo River, to the north and west by wetlands, to the south and southwest by a gravel mining operation, and to the south and southeast by industrially developed lands and the Plainwell Dam (which is scheduled to be removed as part of the U.S. EPA-approved TCRA in 2007-2008). The Plainwell Mill site covers approximately 36 acres and is bordered by the Kalamazoo River to the north (to the top of the river bank, as defined in the CD), the Plainwell central business district to the east, residential properties to the south, and commercial properties and the City of Plainwell wastewater treatment plant to the west.

Plainwell, Inc. is the current owner of the 12th Street Landfill property, although Plainwell, Inc. is a bankrupt entity with no on-going business operations. Weyerhaeuser is currently in negotiations with Plainwell, Inc. to take ownership of the 12th Street Landfill property. The City of Plainwell is the current owner of the Plainwell Mill property, having purchased the mill site out of the Plainwell bankruptcy in 2006. The mill property has been vacant since the former Simpson Plainwell Paper Company filed for bankruptcy in 2000. Weyerhaeuser owned and operated the mill for approximately a 9-year period, between 1961 and 1970. During that time period, dewatered sludge from wastewater treatment operations was excavated from lagoons on the mill property and transported for disposal at the 12th Street Landfill site.

1.4 Applicability of the FSP

This FSP is applicable for work performed by Weyerhaeuser under its 2005 CD with the U.S. EPA and for other specified work in areas to be determined. The FSP currently addresses work at Operable Unit No. 4 – 12th Street Landfill and will later address Operable Unit No. 7- Plainwell Mill Site as well as other locations to be specified later. As such, applicable sections are designed to address both OU-4 and OU-7, however, specific SOPs will be included as needed for OU-7.

The organization and specific QA/QC activities associated with the remedial investigation program are presented in the Multi-Area QAPP, which was submitted under separate cover.

This FSP has been developed in general accordance with the U.S. EPA's document entitled, "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA," dated October 1988.

1.5 Scope

This FSP provides guidance for the various fieldwork activities by defining the sampling and data-gathering methods to be used. The scope of the document is outlined as follows:

- Section 1 provides the introduction, purpose, and scope of the FSP.

- Section 2 describes a summary of the sampling program, including sample locations and frequency.
- Section 3 covers the logistics of sample designation and field records.
- Section 4 summarizes the sample handling and analysis procedures to be followed. Details regarding the sample analytical procedures are discussed in the QAPP.
- Section 5 describes field physical measurements.
- Section 6 describes management of investigation-derived waste.

Figure 1-1 Site Location Map

Figure 1-2 Kalamazoo River Superfund Site

Section 2

Summary of Sampling Program

2.1 Introduction

Environmental sampling for the various activities associated with OU-4 and OU-7 will include sampling of various media to meet a range of information needs. These information needs will vary depending upon the specific tasks being conducted. At a minimum, this Multi-Area FSP will be used to support the following work activities:

- Operable Unit 04 – Emergency Response to TCRA Activities in the Former Powerhouse Discharge Channel and RD/RA activities defined in the CD and SOW
- Operable Unit 07 – Emergency Response to TCRA Dam Removal Activities and RI/FS and RD/RA activities defined in the CD and SOW

Specific information needs will include:

- sampling subsequent analysis to characterize existing conditions and the nature and extent of PCBs within the Site,
- sampling to obtain engineering data and information needed to design emergency or remedial actions, and
- sampling and subsequent analysis to monitor the implementation effects of remediation actions and sampling to confirm conditions after emergency/remedial actions in order to demonstrate that the activities are successfully completed.

Four of the SOPs included in this Multi-Area FSP (F-1 through F-4) are provided in Appendix A (*i.e.*, Worksheet #21 from the Multi-Area QAPP). In addition, an SOP for Soil Sampling with a Direct Push Sampler (F-5) has been included in this Multi-Area FSP. Other SOPs identified during later work plan submittals will be included as described in Section 1.2. These SOPs are specifically for activities associated with OU-4. Additional SOPs will be added as necessary for activities associated with OU-7.

DQOs are established in the Multi-Area QAPP, focused engineering data collection work plans, and additional Area-specific work plans, as appropriate. As information is developed for specific work activities, more detailed information regarding sampling rationale, sample locations, numbers of samples, and sample analyses as well as SOPs will be provided as addenda to this Multi-Area FSP.

2.2 OU-4: Emergency Response – Former Powerhouse Discharge Channel Sampling and Monitoring Activities

The following subsections describe sample collection procedures, sample handling methods, and other procedures pertaining to the following general sampling categories:

- Surface water sampling and field measurements
- Surface water and flow measurement
- Water treatment system sampling
- Sediment sampling
- Soil sampling using direct push equipment

SOPs for each type of sampling activity are provided in Appendix A. These SOPs describe or reference ancillary procedures for equipment cleaning, field measurements, and calibration and maintenance of field instruments, as appropriate.

2.2.1 Sample Collection Procedures

Water Monitoring and Field Measurements

Surface water monitoring and field measurements will be performed during the emergency action activities to meet various objectives including:

- Measurement of surface water PCB and total suspended solids (TSS) concentrations in river water.
- Measurement of potentially transported PCBs and suspended sediments in river water.
- Monitoring of trends in surface water PCB concentrations over time.
- Monitoring of the relative effects of removal activities on turbidity and PCBs in the main river water column outside the channel during the removal actions.
- Monitoring of turbidity of infiltrating groundwater to establish discharge location.
- Evaluation of water quality associated with the water treatment system.

Several data collection methods will be used to achieve these objectives, depending on the purpose and intent of the data, and the DQOs specified in the applicable area-specific work plan and FSP addendum. SOPs for surface water data collection are provided in appendices to this document that can be used together or separately as needed to satisfy the goals of data collection. Specific SOPs are provided for:

Surface Water and Field Measurement Procedures (SOP F-1). This SOP will be used for the collection of a water column sample for laboratory analysis and can be applied to grab samples, vertically integrated samples, bottle sampling, or sampling using a specific device, such as an ISCO automated sampler or peristaltic pump. This SOP will be used for most samples collected from the river for PCB and TSS analysis. It can also be

used for the collection of grab samples from an open channel, the end of a pipe, or from anywhere within a water treatment stream. This SOP includes the use of standard hand-held metering devices and should be used to collect field measurements of surface water quality parameters including turbidity, temperature, dissolved oxygen (DO), and conductivity.

Surface Water Flow Measurement Procedures (SOP F-2). This SOP will be used to measure flow in the river by measuring cross-sectional area and velocities across the channel at the point of measurement.

Water Treatment System Monitoring Procedures (SOP F-3). This SOP describes the field procedures for collection of in-field water treatment system measurements including grab samples for PCB analysis at the effluent of the water treatment system, grab samples for TSS at the effluent of the water treatment system, and grab samples for phosphorus at the effluent of the water treatment system.

Sediment Sampling

Sediment sampling will be performed during the OU-4 Emergency Response activities to meet various objectives, including:

- Identify the distribution and physical characteristics of sediments.
- Characterize the nature and extent of PCBs in sediments present in the Former Powerhouse Channel.
- Monitor the effects of removal activities and determine post-removal PCB concentrations in sediment.

To support these objectives, sediment samples will be collected as intact cores to provide samples at depth, or as surficial grab samples to characterize the sediment at the top of the sediment bed. Core samples will be collected using polycarbonate tubing unless other methods are identified by the area-specific work plan or FSP addendum. Surface grab samples will be collected using sediment core methods or using a petit Ponar dredge. SOPs for sediment collection methods are provided in:

Sediment Sampling Procedures (SOP F-4). This SOP provides field procedures for the collection of sediment samples, sediment cores, and probing for bathymetric surveys.

Geotechnical Soil Sampling

The purpose of the geotechnical investigation is to determine the extent, height and width, and materials used in the berm along the Kalamazoo River so that a slope

stability evaluation can be completed. The location of the berm will be used to assess potential adverse affects to the stability of the fill material that may occur as a result of cutting back existing material along the riverfront. Visual observation of the materials used in the construction of the berm will be used to approximate the physical characteristics of the material, which will be used in the stability model. Together, the location and the physical characteristics of the berm will be used to model the stability of the landfill, provide data to help assess whether or not the vegetation present along the river can be preserved, and ultimately to provide inputs to the design of a stable final slope.

Soil Sampling Procedures with Direct Push Equipment (SOP F-5). This SOP provides field procedures for the collection of soil samples utilizing a direct push sampler.

2.2.2 Sample Locations

Specific sample locations depend upon both the types of samples being collected and field conditions. Many sample locations will be established based in the field based upon sit specific conditions that impact the ability to collect representative samples and the guidelines in the work plan, QAPP and this FSP. Available information by sample type is summarized Table 2-1.

Additional details regarding the sampling program are included in Table 3-1 of the Design Report.

Table 2-1
Summary of Sample Types and Locations

Type of Sample	Assumed Location	Purpose
Surface Water Quality	Immediately upstream or near the Plainwell Spillway. Mid depth in the water column.	Establish background conditions for turbidity comparisons. <u>Turbidity will be measured hourly during channel excavation activities.</u>
	Approximately 200 and 300 feet downstream of the former powerhouse discharge channel. Sample within the channel may be collected from pier or boat depending upon flow conditions. Mid-depth in the water column.	Establish water quality during removal activities. <u>Turbidity will be measured hourly during channel excavation activities.</u>
	Groundwater collection sump (or equivalent) within isolated removal area (discharge water).	Measure turbidity for comparison to background conditions and determination of discharge location. <u>Turbidity will be measured approximately every three hours during pumping acitivities</u>
Surface Water Flow Measurements	To be determined if needed.	To be determined if needed.

Type of Sample	Assumed Location	Purpose
Water Treatment System Monitoring	Effluent sampling from Portable Treatment unit.	To confirm treatment system effectiveness.
Sediment Sampling	At selected nodes within a final sampling grid. Grid size depends upon the final size of the removal area. Node selections will consider random and spatially distributed locations. Samples will be collected within the top 6 inches of sediment.	Document PCB sediment concentrations after removal is complete.
Geoprobe Soil Sampling	Predesign sample collection at transects along the edge of the landfill closest to the former powerhouse discharge channel.	Determine possible existence of former berm at edge of landfill and assess collected soil samples for implications on slope stability.

2.3 Investigation-derived Waste Sampling

2.3.1 Decontamination Water

All decontamination water generated during cleaning of equipment will be stored in a temporary storage tank(s) at the site. During operations, the water will be treated in the on-site treatment system. Decontamination water that is generated after the treatment system is unavailable will be characterized to identify appropriate methods of off-site treatment and/or disposal. The water samples will be analyzed for the analytes required by the treatment and/or disposal facility.

2.3.2 Soil

Soil cuttings generated during the drilling of geoprobe soil borings will be placed in appropriate temporary containers until all drilling operations are completed. At that time, representative samples will be collected to allow for the disposal of this material either at the 12th Street Landfill or at an off-site, permitted disposal facility (if required).

Section 3

Sample Designation, Control, and Field Records

3.1 Sample Designation

Samples will be assigned a unique alpha-numeric sample descriptor identifying the media types, the sample location, and in certain instances, the sample depth (or sample number). Each sample will be labeled as follows:

[sample location] - [sample matrix] - [sample number] - [sample date] (YYMMDD)

The following sections discuss the sample numbering system in greater detail.

3.1.1 Sample Location

The first entry for each alpha-numeric sample descriptor will be a sample location designator, which will be assigned as described below.

- PDC – Former Powerhouse Discharge Channel
- LF – 12th Street Landfill
- PM – Plainwell Mill
- WTS – Water Treatment System

3.1.2 Sample Matrix

The second portion of each alpha-numeric sample descriptor will be a two-letter alphabetical code that describes the sample matrix. Matrix codes for the investigation are as follows:

- “SD” for sediment
- “SW” for surface water
- “SL” for soil
- “EW” for effluent water from treatment system
- “FB” for field blanks
- “TB” for trip blanks
- “FD” for blind field duplicate samples

3.1.3 Sample Number

For environmental samples, a unique sample number will be designated for each new physical sample collected. For example soil boring number one at the 12th Street Landfill will be named LFSL01. For soil or sediment borings where more than one subsurface sample is obtained at a given location, each sample name will include a “D” followed by the sample depth range in feet (*e.g.*, 0 to 0.5 feet; LFSL01D0.0.0.5ft). Water samples taken at a specific depth will only include the specific depth (not a range). In addition, the sample name will also include an identifier for the specific monitoring location upstream or downstream of the work activities and its relative monitoring position moving from upstream to downstream (*e.g.*, 1st Upstream location, U1; Downstream of activities and downstream of two other sampling stations, D3). The position of each surface water station will be recorded with a GPS and written into the appropriate field log book. The specific depth interval at which each sample is collected will be recorded to the nearest tenth of a foot in the comments section of the Chain-of-Custody Record and in the appropriate field notebooks.

For QA/QC samples such as field blanks, trip blanks, and blind duplicates, samples will be numbered sequentially beginning with “001” and will be recorded in the appropriate field notebook. A sample for which additional volume is collected for matrix spike/matrix spike duplicate analyses will have the suffix of “-MS/MSD” added to the sample identification number.

3.1.4 Sample Date and Time

For each sample the date and time will be noted in the appropriate field log books and on the COC. The sample date and time will be recorded using 2-digit numeric codes for the year, month, and date of the sample (*e.g.*, 070501 would be the sample date for a sample collected on May 1, 2007) and military time (24:00).

Example Sample Description	Associated Sample Naming Convention
The first sediment boring collected in the former powerhouse discharge channel. Depth collected was 1 to 2 feet. Sample date and time was July 1, 2007, at 1:00 p.m.	PDCSD01D1.0.2.0ft
Fifth water surface sample collected at the second downstream monitoring location at the powerhouse discharge channel. Surface water sample collected at a mid-depth of 3 feet on July 2, 2007, at 7:00 a.m.	PDCSW05D3.0ftD3

3.2 Sample Containers and Preservation

The sample containers, preservation and handling procedures will follow the standard analytical requirements as described in the QAPP and collection procedures described in the SOPs. The analytical laboratory will supply the appropriate containers for sample collection and preservation. The field personnel is responsible for proper collection, labeling, recording and preservation (*i.e.*, on ice) of samples. Sample containers will be labeled in accordance with the sample designation, date and time described in Section 3.1.

3.3 Chain-of-Custody Procedures

The sampler is responsible for sample custody from the time of sample collection to receipt at the laboratory or until samples are shipped by commercial carrier. A sample is considered under custody if one of the following conditions apply:

- The sample is in a person's possession.
- The sample is in that person's view after being in his or her possession.
- The sample was in that person's possession and then placed in a secured location.
- The sample is in a designated secure area.

Sets of sample containers that are shipped together will be assigned a Chain-of-Custody Record, which will travel with the sample containers. A copy of the Chain-of-Custody Record with its assigned sample numbers will be kept in the laboratory to help identify samples that might become separated from the discrete sample delivery group. When shipped by a commercial carrier, custody seals will be attached to each cooler to ensure that tampering with the samples does not occur in transit, and the shipment airbill will be kept as Chain-of-Custody documentation.

3.4 Field Records

This section of the FSP describes requirements and procedures for documentation of field activities. It is essential that all field documentation provide a clear, unbiased description of field activities. Examples of all of the forms mentioned in this FSP are included in Appendix B.

3.4.1 Daily Log

Serially numbered, bound field notebooks will be used on work assignments requiring field activities. Daily field activities will be recorded in the bound field notebooks. In addition, several sample collection notebooks will contain bound sample collection forms, including soil boring logs, monitoring well construction diagrams, monitoring well development forms, groundwater sampling summary forms, and groundwater and surface water level measurement forms.

Representative forms are provided in Appendix B. RMT's on-site coordinator (OSC) will be

responsible for issuing field notebooks. A record will be maintained by the OSC documenting the assignment of field notebooks. RMT's OSC will distribute and track bound and numbered field notebooks. Transfers of field notebooks to other individuals (including subcontractors) who have been designated to document specific tasks on the project will be recorded. No field notes may be destroyed or discarded, even if they are illegible, or known to contain inaccuracies.

Entries into field notebooks will be legibly written and will provide a clear record of field activities. Entries will be made in waterproof ink and in language that is objective, factual, and free of personal opinions or terminology that might later prove unclear or ambiguous. Errors in the field notes will be indicated by drawing a single line through the text, such that the text in error remains legible. Errors addressed in this manner will be initialed and dated by the person making the correction. The person taking notes in the field notebook will sign, number, and date each page and will document the date, time, location on site, name of field personnel present, and weather conditions observed. Specific sample collection methods will be included in the field notes.

Field personnel responsible for taking notes will log photographs in the field notebook. Locations of the photographs will be referenced to a site sketch or map. Use of measurements and readings from on-site health and safety equipment will be recorded. Observed potential hazards to health and safety will be described. The level of protection and the decontamination procedure used will be documented.

3.4.2 Soil Boring Logs

Soil borings completed by the field team will be documented in a Soil Boring Log. The log will document the drilling locations, drilling dates and times, names of drilling personnel and logging personnel, soil descriptions, sample depths, and recovery.

3.4.3 Soil Sample Logs

Soil samples collected by the field team will be documented in a Soil Sample Log. The log documents the sample identifiers; soil types; sampling times, depth and location of each sample; sampling equipment used; color, odor, and appearance of the samples; sample parameters; container descriptions; sample preservatives; and names of sampling personnel.

3.4.4 Water Sample Log

All surface water and/or groundwater samples collected by the field team will be documented in a Water Sample Log. The log will document the sample identifiers, replicate identifiers, if any;

purging (groundwater) and sampling times and locations; sampling equipment; color, odor, and appearance; sample container descriptions; sample preservatives; and sampling personnel.

3.4.5 Sediment Sample Log

All sediment samples collected by the field team will be documented in the Sediment Sample Log. The log will document the sample identifiers, replicates, sample times, date and location. In addition, sediment appearance, type color, odor etc, will be described. Sample containers, preservatives and sampling personnel will be recorded in the Sediment Sample Log.

3.4.6 Chain-of-Custody Record

The Chain-of-Custody (COC) Record is a multi-copy record, which documents the custody of the samples from sample collection through laboratory analysis. The record includes spaces for signatures of those receiving and relinquishing the samples. The sampler, the individual preparing the samples for shipment, and the individual receiving the samples at the laboratory normally sign the record.

The field personnel collecting the sample will fill out the COC Records. The COC process will be initiated upon sample collection. The field person who signs the record will be responsible for the samples until they are transferred to the custody of the laboratory or another custodian. Once the record has been completed, all remaining field sample identification spaces will be crossed through to prevent unauthorized addition of sample information.

The information required on the COC Record includes the complete sample identifier, date and time of sample collection; number of sample containers; analyses and methods required; container type; project number; name of sample collection personnel; complete name, address, and telephone number of the person who will receive analytical reports; turnaround time; and signatures of all sample custodians, excluding shippers. In addition, the method of shipment, and the courier's name and air bill number must be included. The back copy of the record will be retained. The original record will accompany the sample shipment to the laboratory.

3.5 Photographs

As discussed in subsection 3.4.1, photographs taken in the field will be documented in the field notebook at the time the photograph is taken. Locations of photographs will be referenced to a site sketch or map. After the film is developed or the images are uploaded onto a computer, the photographs will be labeled with the following information:

- Project identification number
- Date

- Location
- Direction viewed in photograph
- Roll number (if applicable)
- Frame number
- Sample number (if appropriate)
- Initials of the photographer

Section 4

Sample Handling and Analysis

This section presents general sample handling and analysis protocols. Additional detailed information is contained in the QAPP.

4.1 Sample Containers and Shipping

A table summarizing the sample containers, preservation methods, and holding times for solid and liquid samples, which are collected under this Multi-Area FSP and intended for chemical analyses, is provided in Appendix C (*i.e.*, Worksheet # 19 from the Multi-Area QAPP). These sample containers, preservation methods, and holding times meet U.S. EPA and Michigan Department of Environmental Quality (MDEQ) standards. For samples intended for VOC analysis, the sample containers will be filled completely to minimize airspace. Sample containers for other analytical group analyses will be filled to nearly full to avoid overtopping and loss of preservative (if applicable), and to meet the minimum sample volume/mass required by the laboratory (see Worksheet # 19 in Appendix C). Soil samples intended only for physical testing (*e.g.*, grain size) will be placed in clean glass jars (minimum 8-oz. volume).

From the time the samples are collected and labeled until delivery to the laboratory, samples will be kept in a dark or otherwise lower temperature location, on ice and within a hard plastic ice chest or cooler that has a white interior. For delivery of samples to the laboratory, the following procedure will be implemented:

1. Collect and preserve the samples as outlined in the FSP and QAPP.
2. Place sample containers in a laboratory shipping container(s). Samples will be packed securely with packing material to protect sample containers from accidental breakage during shipment and to prevent leaks or spills.
3. Fill shipping container with enough ice to last the trip. Double-bag the ice to ensure sample integrity. Dry ice and/or blue ice (ice packs) will not be used.
4. Complete the Chain-of-Custody Record as described in Subsections 3.3 and 3.4.6 and in the QAPP.
5. Tape the Chain-of-Custody Record to the inside of the shipping container lid.
6. Seal shipping container with strapping tape, and place a custody seal (provided by the laboratory) on the shipping container prior to shipping.
7. Deliver or ship the container to the laboratory using an overnight shipping service.

Responsibility for proper use of containers and preservatives will be under the oversight of RMT's OSC.

4.2 Selection of Parameters

The number and location of the samples to be collected and the selection of parameters to be analyzed are summarized in Table 2-1 and in Appendix C (*i.e.*, Worksheets #17 and #18 from the Multi-Area QAPP).

4.3 Analytical Procedures

The selection of analytical procedures reflect U.S. EPA-approved methodology from the SW-846 Methods and MDEQ-approved methodology under the Michigan Part 201 Program, where applicable, as stated in the QAPP. Other methods designed to meet project-specific objectives are also defined in the QAPP. A list of the analytical procedures is provided in Appendix C (*i.e.*, Worksheet # 23 from the Multi-Area QAPP).

4.4 Sampling Quality Assurance Procedures

The sample collection procedures presented in this FSP are designed to provide samples of the required quality to meet site investigation objectives. All field personnel will be required to understand the requirements of this FSP and will be trained in the use of the specified equipment and techniques.

The RMT OSC is responsible for reviewing the day-to-day activities to ensure that the procedures in the FSP are followed. Specific activities that will be implemented by the RMT OSC include the following:

- Convene a meeting of field personnel at the start of a specific sampling event to review the sampling requirements of the FSP, the necessary equipment and decontamination requirements and use, and the required documentation.
- Review all documentation on a daily basis for completeness, errors, problems, and corrective actions taken.
- Convene daily project team meetings at the start of the day to discuss health and safety, to address any problems developed during the previous day's work, and to review the work to be completed that day.
- Manage the implementation of in-field corrective actions. The RMT project manager will be notified of significant problems and, if necessary, will work with the OSC to develop corrective actions. The project manager will be responsible for implementing corrective actions that need to be applied to areas other than field activities.

4.4.1 Field Measurements

The equipment used for in-field measurement will be maintained, calibrated, and operated in the field according to the procedures described in the select SOPs in Appendix A. Field calibration of equipment is described within the QAPP worksheet #22. The process will be documented, and RMT's OSC will periodically review the documentation and inspect the equipment to ensure that the procedures are followed by the personnel collecting the samples. Significant deviations from the FSP, errors, equipment failures, or other problems will be documented in a bound notebook by

RMT's OSC and reported to the RMT project manager. Corrective actions and additional notifications will be coordinated by the project manager.

4.4.2 Sample Collection

Personnel involved in the collection of samples are required to read, understand, and follow the procedures specified in this FSP. Problems that may affect the quality of the sampling effort will be documented by the field personnel most directly involved with the problem, and RMT's OSC will be notified. RMT's OSC is responsible for coordinating the development and implementation of corrective actions with the RMT project manager.

4.4.3 Field Data Reduction

Raw data from field measurements and sample collection activities will be recorded in the field logs as specified in Section 3.4. With the exception of the temperature correction for specific conductance, no calculation will be required in field data reduction. Only direct-reading instrumentation will be employed in the field. The OSC will proofread all forms and notebooks to for consistency with the planned activities and to also determine if transcription errors have been made by the field crew.

4.4.4 Analytical Quality Assurance Considerations

Field Duplicates

Blind field duplicate samples, prepared by splitting a single sample into two separate containers, will be used to evaluate sampling precision. Points at which duplicate samples are to be collected will be selected by field personnel and will be submitted as blind duplicates to the laboratory. Field personnel are expected to provide a general range of expected concentrations to the laboratory for these samples to minimize impacts on laboratory equipment.

Blind field duplicates will be collected at a frequency of one sample per 10 primary samples for soil and groundwater matrices, as summarized in Appendix C (*i.e.*, Worksheet # 20 from the Multi-Area QAPP). Sample identification protocols are provided in Subsection 3.1 of this FSP.

Field Equipment Blanks

Field equipment blanks consisting of analyte-free water will be collected and submitted to the analytical laboratory to assess the quality of the data resulting from the field sampling program. Field equipment blanks are analyzed to check for procedural

contamination at the site that may cause sample contamination. Field equipment blanks will be collected following decontamination of the nondedicated sampling equipment, including pumps and soil samplers. Field equipment blanks will not be collected for disposable or dedicated sampling equipment, such as tubing dedicated to a specific well.

Field equipment blank frequencies are also provided in Worksheet #20 of the Multi-Area QAPP (see Appendix C). In general, field equipment blanks will be collected at the rate of one duplicate per ten primary samples for groundwater and soil matrices. Identification protocols are provided in Subsection 3.1 of this FSP.

Field Blanks

Field blanks will be analyzed to assess the suitability of the container, preservative, and sample handling. The field blank is generated by pouring the solution provided in one of the sample containers into another sample container the contents of which had been emptied at the facility. One field blank will be collected per every 10 primary samples, as described in Worksheet # 20 of the Multi-Area QAPP (see Appendix C).

Field blanks will be denoted by “F” followed by a 3-digit number, similar to the system used for duplicate samples (F-001-[Date], F-002-[Date]).

Matrix Spikes/ Matrix Spike Duplicates (MSs/MSDs)

MS/MSD samples provide information about the effect of the sample matrix on the sample preparation and measurement methodology. MS/MSD samples will be analyzed in accordance with the laboratory operating procedures provided in the QAPP. In conjunction with other QC data, the spikes and duplicates give information on the precision and accuracy of the analytical method on the various sample matrices. One MS/MSD sample will be collected and prepared for every 20 or fewer primary samples collected during a sampling round, as described in Worksheet #20 of the Multi-Area QAPP (see Appendix C). The MS/MSD samples will consist of triple the normal sample volume for each analytical group, provided adequate sample volume is available. Field personnel will select the sampling locations at which MS/MSD samples are collected. MS/MSD identification protocols are provided in Subsection 3.1.

4.5 Field Audits

The Project Manager/Coordinator will monitor daily field performances through daily communications with RMT's OSC and Construction Manager. Field performance audits and field system audits will be performed as follows:

- Field performance audits will be conducted in order to confirm that the activities are being performed according to the established plans. The field performance audits will be performed by the Senior Consultant QA Manager (or designee) at an appropriate frequency for the field activities. The audits will include a discussion of the project progress with the Project Coordinator and /or the review of field reports, as appropriate. The Senior Consultant QA Manager will record and document any observations made during field system audits, and will discuss the audit and any recommended changes/deviations to the field procedures with the project coordinator.
- Field system audits will be performed by the data QA manager including a review of rinse and trip blank data to identify potential deficiencies in field sampling and decontamination procedures, and a comparison of the scheduled QA/QC activities described in the QAPP with the QA/QC procedures being performed on the project. Field system audits will be performed at a frequency appropriate for field activities. The Data QA Manager will record and document any observations made during field system audits, and will discuss the audit and any recommended changes/deviations to the field procedures with the Project Coordinator.

4.6 Corrective Action

Field measurement corrective action may be necessary when the sample network is modified or when sampling procedures and/or field analytical procedures require modification in response to unexpected conditions. Technical staff and project personnel will be responsible for reporting all suspected technical or QA nonconformances or deficiencies of any activity or issued document by reporting the situation to the RMT on-site Field Sampling Coordinator or designee. The Field Sampling Coordinator will assess the suspected problems in consultation with the Project Coordinator or Data QA manager or designee, and will assist in making a decision based on the potential for the situation to impact the data quality. If it is determined that the situation warrants a reportable nonconformance requiring corrective action, RMT's OSC will issue the nonconformance report. If appropriate, the RMT Field Sampling Coordinator will ensure that no additional work is dependent on the nonconforming activity is performed until the corrective actions are completed.

Details regarding laboratory data reduction, validation and reporting requirements are provided in Worksheet #14 and Worksheets # 34 through #36 of the QAPP (see Appendix C). In addition details on field and laboratory audits and corrective actions are included in Worksheets #6, #14, #31, #32, and #33 of the QAPP (see Appendix C).

Section 5

Field Physical Measurements

Field measurements of topographic features, water levels, reference points, and other physical features will be required during the field investigations. The scope of such measurements depends upon the purpose for the particular measurement data.

Physical measurements will be traceable to the person making the measurement and to the specific piece of field equipment used to make that measurement. Equipment maintenance and calibration records will be kept in a bound field notebook, making all such procedures traceable. Time records will be kept using local time in the 2400-hour military format, recorded to the nearest 5 minutes.

Sampling locations will be surveyed and depicted on existing topographic maps. Surveying will be conducted according to the standard procedures described below. Control points used during the survey will be marked in the field and noted on the topographic maps.

Surveying of Sampling Locations

Accurate, complete, and informative surveying field notes are a primary objective in site mapping. The field notes are the most reliable record of measurements made and information gathered in the field. As stated in Subsection 3.4, information gathered will be recorded in bound notebooks. Notes will be permanent, legible, and complete.

The field notes will accomplish the following:

- Provide adequate and complete information that can be understood by someone other than the notetaker.
- Provide documentation of work completed or data gathered.

Two important aspects of each survey to be addressed in the field notes are as follows:

- ***Starting and ending points of the survey*** - The surveyor will explain and document the starting and ending points of the survey. This applies to both horizontal and vertical control. This will require a paragraph of explanation and sketches and/or cross-references to data in notes of previous surveys.
- ***Clear indication of final results and checking procedures*** - The final results and checks will be plainly indicated. Erasures will not be used, as they raise uncertainties about the reliability of the data. Alterations, additions, revisions, reductions, or comments added to field notes will be written in colored ink to indicate that such information is not part of the original field record. The person making such notations will initial and date each page so affected.

The following is a checklist of information to be included in the notebook:

- Date
- Names of survey crew members
- Weather conditions: observed temperatures, relative wind speed, and barometric pressure if an electronic distance meter (*e.g.*, a total station) is to be used
- Equipment used, listing the serial number or other identification
- Location of survey by section description or other legal parcel identification
- Project number
- North arrow
- Description of all monuments found
- Measurements (slope distance and vertical angles, temperature, taping, horizontal angles, etc.)
- Corrected distances and angles
- Description of monuments set
- Outline or sketch of major traverse or property boundary

The elevation of the monitoring wells will be surveyed to a known datum point allow correlation of water levels. Additionally, ground elevations may be required for topographic purposes. Standard engineering leveling techniques, as described in basic surveying textbooks, establish the methodology for providing vertical control. The datum referenced for elevation control is the National Geodetic Vertical Datum (NGVD) of 1929, informally known as sea level datum, established by the U.S. Coast and Geodetic Survey. Benchmarks of known elevation will be used. If no benchmark is located in the vicinity of a site investigation, an arbitrary temporary benchmark will be established on a permanent location (*i.e.*, foundation or corner post). The locations of benchmarks utilized will be shown on a site sketch map. Elevation surveys will be conducted to form a circuit (*i.e.*, the survey line will be closed back to a benchmark). Third-order accuracy will be obtained on level circuits; for example, on a 1-mile circuit, the closure will be within 0.05 foot. Length of sight will not ordinarily exceed 250 feet, with turning point back-shots and fore-shots deviating no more than 50 feet from one another.

Section 6

Management of Investigation-derived Waste

6.1 Purge Water and Decontamination Water

Wastewater produced from well development and well purging and decontamination water will be temporarily stored in appropriately sized container and managed as described in Section 2.3.1.

6.2 Soil

Soil that is produced during the drilling operations will be temporarily stockpiled at each drilling site and placed on a plastic liner. In the event of rain, and at the end of each work day, the pile will be covered with a plastic sheet. As drilling is completed at each work area, the temporary stockpile will be collected and placed into either the sediment or soil management areas at the top of the 12th Street Landfill, or into roll-off bins, drums, 5-gallon buckets, or equivalent located in the primary staging area. After all drilling operations are completed, samples of the accumulated soil will be collected and characterized in accordance with landfill profile requirements. After determining the proper regulatory classification, the soil will be transported for off-site disposal at the 12th Street Landfill site or another permitted disposal facility (if necessary).

6.3 Used Personal Protective Equipment and Noncontaminated Refuse

Used personal protective equipment and other types of general noncontaminated debris or waste materials produced during the fieldwork will be collected daily in sealed plastic bags, and placed in a waste dumpster that will be brought to the site for the project. The wastes will be disposed by a local commercial waste disposal contractor at the end of the fieldwork.

Section 7

References

MDEQ, 2004 Michigan Department of Environmental Quality Remediation and Redevelopment Division Operation Memorandum Number 2, Attachment 7

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Syed, A.U., Bennett, J.P., and Rachol, C.M., (2004). A pre-dam-removal assessment of sediment transport for four dams on the Kalamazoo River between Plainwell and Allegan, Michigan: U.S. Geological Survey Scientific Investigations Report 2004-5178, 41 p.

Robert R. Wells, Eddy J. Langendoen and Andrew Simon. (2003). Numerical Simulation of Sediment Loads and Channel Changes along the Kalamazoo River between Plainwell and Otsego, Michigan. Research Report - No. 44. Mississippi: Oxford, Mississippi, U.S. Department of Agriculture Sedimentation Laboratory.

Rachol, C.M., Fitzpatrick, F.A., and T. Rossi., (2005). Historical and Simulated Changes in Channel Characteristics of the Kalamazoo River, Plainwell to Otsego, Michigan: U.S. Geological Survey Scientific Investigations Report 2005-5044.

Appendix A

Standard Operating Procedures

Standard Operating Procedure F-1

Water Sampling and Field Measurement Procedures

This standard operating procedure (SOP) sets forth the field procedures for the collection of water column samples via boat, sampling from shore, or sampling from a bridge. Water column samples will be collected using a stainless steel Kemmerer water sampler, utilizing a peristaltic pump with Teflon tubing, or using an ISCO automated sampler. Samples collected downstream of construction to monitor TSS and PCB transport will utilize an ISCO automated sampler. Treated water from construction activities will be obtained using a direct grab sampling method.

Decontamination Procedures for Nondedicated Sampling Equipment

Proper decontamination of sampling equipment is essential to minimize the possibility of cross-contamination of samples. Nondedicated equipment used for sampling various environmental media (soil, groundwater, surface water, etc.) will be cleaned before its initial use in the field and again before use at each subsequent sampling site.

All nondedicated sampling equipment will be new, or will be decontaminated at RMT prior to its initial use on-site. Decontamination procedures will include the following steps:

1. Wash the equipment in a nonphosphate detergent.
2. Rinse with potable tap water.
3. Rinse with deionized (DI) or distilled water.

The submersible pumps are not designed to withstand acid rinsing. Decontamination of this equipment will therefore consist of washing the downhole portions of the equipment with nonphosphate detergent and rinsing with DI or distilled water.

Nondedicated equipment that is to be used at additional locations at the site will be field-decontaminated between sampling locations. Details regarding the decontamination of field equipment is included in the sampling procedures described below. The field decontamination procedures will be in accordance with the Michigan Department of Environmental Quality (MDEQ) Remediation and Redevelopment Division Operation Memorandum Number 2, Attachment 7 (MDEQ, 2004).

The field decontamination of sampling equipment will take place at the sampling location. All decontamination water will be contained in 5-gallon buckets and transported to the decontamination pad for collection with other decontamination wastewater.

The field equipment blanks will be collected in accordance with the sampling methodology specified in Attachment 7 (MDEQ, 2004).

To the extent practicable, single-use sampling equipment and materials will be used for the collection of all environmental samples. The materials used will be new and clean, and will be placed in plastic for

transport to the site. Once used, this equipment will be placed in plastic bags and managed as investigation-derived waste material.

Water Column Sampling Procedures

Water column samples will be collected using a stainless steel Kemmerer water sampler, a peristaltic pump with Teflon tubing, or a discrete grab sample in appropriate sample containers. The sample collection method will be determined based on river flow, water depth, and site conditions at the time of collection. The Kemmerer sample collection device is lowered to the appropriate sample depth on a cable in an open position and a weighted messenger is sent along the cable to trip the sampler closed. The peristaltic pump with disposable silicone pump tubing and Teflon sample tubing is lowered to depth and directly pumps water from the river. Grab sample collection is utilized for shallow water river conditions or when collecting water out of a sample port for water treatment system evaluation.

Prior to initiating field activities, the water quality meter will be calibrated according to the manufacturer's instructions and the calibration data recorded in the logbook or on the Water Quality Meter Calibration Log. The procedures for collection of water column samples are provided below.

1. Record the sample location on the sample log or in field notebook along with other appropriate information [include a sketch indicating location relative to shore features, if appropriate].
2. Don health and safety equipment (as required by the Multi-Area HSP).
3. Decontamination of the sampling equipment prior to initial use, between sampling at each transect, and at the completion of sampling as follows: distilled water rinse; acetone rinse; hexane triple rinse; and distilled water triple rinse. All decontamination rinsate water will be contained in a MDOT-approved container. If using a peristaltic pump with disposable tubing or a discrete grab sample into appropriate lab supplied glassware, no equipment cleaning is needed.
4. Prepare one rinse-blank sample prior to and after sampling activities, by pouring deionized water supplied by the laboratory through the cleaned Kemmerer and filling the sample containers as described in Steps 8 and 9. If a peristaltic pump and Teflon tubing or a discrete grab sample is used, no rinse blanks are required.
5. Measure the total depth of the water column. Initial field checks with a survey rod will be performed to confirm accuracy.
6. Lower the water sampler to 0.8 times the total water column depth and either release the trigger on the Kemmerer, start peristaltic pump, or lower sample bottle.
7. Raise the water sampler from the water column with minimal disturbance, continue to pump river water, or secure grab sample jars.
8. Remove the covers from the appropriate laboratory supplied containers and slightly tilt the mouth of the container below the sampling device.
9. Empty the sampler slowly, allowing the sample stream to flow gently down the side of the sample container (with minimal entry turbulence).
10. Repeat Steps 6 through 9 for collection of sample at 0.2 times the total water column depth.
11. Repeat Steps 5 through 10 at the other river locations.

12. At each station, collect field measurements for temperature, pH, turbidity, conductivity, and DO at 0.2 and 0.8 times the total water column depth record results on the appropriate in the field logbook or Surface Water Sampling Log.
13. Secure all sample jar caps tightly.
14. Label all sample containers.
15. Place filled sample containers on ice in a cooler.
16. Collect field duplicate and matrix spike (MS) and matrix spike duplicate (MSD) samples during each sampling event. Field duplicates and MS/MSD samples will be prepared by filling additional sets of sample containers with water collected at the same time and depth. One additional set of sample containers will be filled for field duplicates and two sets of containers will be filled for MS/MSD samples.
17. Follow procedures for preservation of samples and packing, handling, and shipping with associated chain-of-custody procedures for samples
18. Record required information in the field logbook or Surface Water Sampling Log.

Continuous Water Column Sampling Procedures During Construction

Three movable YSI Sonde units, each equipped with probes to measure dissolved oxygen, turbidity, pH, conductivity, and temperature will be used upstream and two locations downstream of the construction area. The YSI logs the above data at predetermined time intervals. The unit will be programmed to sample hourly during construction operations. The data will be downloaded daily onto a computer hard drive for backup.

Calibration Procedures - The YSI will be calibrated weekly in accordance with manufacturer's instructions. Calibration information will be recorded in the field logbook.

Operation Procedures - The YSI will be operated according to the manufacturer's instructions.

Maintenance Procedures - The YSI will be maintained according to the manufacturer's instructions. Maintenance information will be recorded in the field logbook. A replacement meter and probes will be available onsite or ready for overnight shipment, as necessary.

The units will be placed within a perforated PVC pipe for protection and anchored to the river bottom. A buoy will be attached to the PVC pipe for accessibility, and the unit attached to shore for security. In addition to the Sonde units, a sampling line will also connected to tubing which feed to an ISCO sampler located on shore for discreet sampling of the water throughout the construction activities. Samples will be taken every 15 minutes during material placement.

The water sample that corresponds to the highest turbidity reading over the placement period should be submitted to WATS laboratory for analysis of Total Suspended Solids (TSS), Volatile Suspended Solids (VSS) and polychlorinated biphenyls (PCBs).

Collection Procedures - The procedures for collection of water column samples using the YSI and ISCO sampler are provided below.

1. Record the sample location on the sample log or in field notebook along with other appropriate information [include a sketch indicating location relative to shore features, if appropriate].
2. Measure the total depth of the water column at mid-river location using a portable depth finder. Initial field checks with a survey rod will be performed to confirm accuracy.
3. Place Sonde unit and ISCO intake tubing at a mid-river location, if possible. Attach the tubing to the upstream side of the monitoring using cable ties. Depending upon site conditions, placement of a station at mid-river may not be safe or feasible. In this event, water samples may be collected from a pier or boat.
4. Set the ISCO composite sampler and portable power source on shore and attach to an immovable object (tree, fence, etc) to deter theft/vandalism.
5. Place necessary glassware in the sampler and surround glassware with up to 20 pounds of ice.
6. Attach the intake tubing to the tubing in the pump head. Ensure that the tubing slopes downhill from the pump head to the intake point to ensure draining between sampling events.
7. Program the sampler according the manufacturers instructions including two rinse cycles prior to collection. Set the appropriate sample time and volume to fill an individual container. Ensure that the sampler is in "Run" mode prior to leaving the sampler. Close the top of the sampler for protection against the elements.
8. Retrieve the sample containers from the ISCO sampler upon completion of the timed sampling event.
9. Download the information from the Sonde unit for the timed sampling event.
10. Match the highest turbidity readings from the Sonde unit with the corresponding ISCO sample.
11. Remove the covers from the appropriate laboratory supplied containers and slightly tilt the mouth of the container below the ISCO sample container.
12. Empty the sample container slowly, allowing the sample stream to flow gently down the side of the laboratory supplied sample container (with minimal entry turbulence).
13. Secure all sample jar caps tightly.
14. Label all sample containers.
15. Place filled sample containers on ice in a cooler.
16. Collect field duplicate and matrix spike (MS) and matrix spike duplicate (MSD) samples during each sampling event or as required. Field duplicates and MS/MSD samples will be prepared by filling additional sets of sample containers with water collected at the same time and depth. One additional set of sample containers will be filled for field duplicates and two sets of containers will be filled for MS/MSD samples.
17. Follow procedures for preservation of samples and packing, handling, and shipping with associated chain-of-custody procedures for samples.
18. Record required information on the field logbook or Surface Water Sampling Log.
19. Follow appropriate decontamination procedures describe above for the sample equipment as necessary.

Standard Operating Procedure F-2

Surface Water Flow Measurement Procedures

This standard operating procedure (SOP) describes the field procedures for determining surface water flow at a river transect. In general, these procedures include dividing the width of the channel conveying flow into segments and measuring the average velocity and cross-sectional area of each segment. The total flow is then calculated as the sum of the product of average flow velocity and cross-sectional area of each segment.

Decontamination Procedures for Sampling Equipment

Proper decontamination of sampling equipment is essential to minimize the possibility of cross-contamination of samples. Nondedicated equipment used for sampling various environmental media (soil, groundwater, surface water, etc.) will be cleaned before its initial use in the field and again before use at each subsequent sampling site.

All nondedicated sampling equipment will be new, or will be decontaminated at RMT prior to its initial use on-site. Decontamination procedures will include the following steps:

1. Wash the equipment in a nonphosphate detergent.
2. Rinse with potable tap water.
3. Rinse with deionized (DI) or distilled water.

The submersible pumps are not designed to withstand acid rinsing. Decontamination of this equipment will therefore consist of washing the downhole portions of the equipment with nonphosphate detergent and rinsing with DI or distilled water.

Nondedicated equipment that is to be used at additional locations at the site will be field-decontaminated between sampling locations. Details regarding the decontamination of field equipment is included in the sampling procedures described below. The field decontamination procedures will be in accordance with the Michigan Department of Environmental Quality (MDEQ) Remediation and Redevelopment Division Operation Memorandum Number 2, Attachment 7 (MDEQ, 2004).

The field decontamination of sampling equipment will take place at the sampling location. All decontamination water will be contained in 5-gallon buckets and transported to the decontamination pad for collection with other decontamination wastewater.

The field equipment blanks will be collected in accordance with the sampling methodology specified in Attachment 7 (MDEQ, 2004).

To the extent practicable, single-use sampling equipment and materials will be used for the collection of all environmental samples. The materials used will be new and clean, and will be placed in plastic for

transport to the site. Once used, this equipment will be placed in plastic bags and managed as investigation-derived waste material.

Surface Water Flow Measurement Procedures

The general procedures to be followed when obtaining surface water flow measurements at a river or creek transect are described below.

The following materials will be available, as required, during water column sampling:

- health and safety equipment to be worn when working around surface water, as described in the Multi-Area Health and Safety Plan (HSP)
- field notebook and pen
- calculator
- rope
- survey rod
- duct tape
- 200-foot measuring tape
- electromagnetic velocity meter

Surface Water Flow Measurement Sampling Procedures

The following procedures will be used to determine the velocity profile at a cross-section:

1. Measure the width of the water body, then divide and mark into equally spaced measurement locations. For water bodies less than 30 feet in width, the spacing should be 5 feet. For water bodies between 30 feet and 100 feet in width, the spacing should be 10 feet. For water bodies greater than 100 feet in width, the spacing should be 20 feet.
2. Calibrate the velocity meter according to manufacturer's specifications.
3. Lower the survey rod and measure and record the water depth to the nearest 0.1 foot at each measurement location in the field logbook or on the Velocity Profile Measurement Log. Measurements should be collected at the center of each 5-foot (or 10- or 20-foot) increment.
4. Velocities will be determined using the two-point method. Attach the velocity meter probe to the survey rod, measure and record the velocity in feet per second at depths equaling 0.2 and 0.8 times the total depth at each measurement location. Average the two velocity measurements to obtain the average velocity for that vertical section. Record all measurements in the field logbook or on the Velocity Profile Measurement Log.
5. Calculate the average total flow by multiplying the average velocity reading times the cross-sectional area of the 5-foot (or 10- or 20-foot) increment. The cross-sectional area is determined by multiplying the width of the increment (*i.e.*, 5, 10, or 20 feet) times the average water depth within that increment. The total flow is the sum of the velocity times the area for each increment and can be calculated using the following formula:

$$QT = V1 A1 + V2 A2 + ... + Vn An$$

where:

QT = Total flow in cubic feet per second

V1-n = Average velocity for a vertical section (feet per second)

A1-n = Cross-sectional area of each increment (square feet)

6. For flow measurements at bridges, water surface will be measured using a weighted rope or tape measure as a “tape down” distance from a distinct reference point on the bridge.
7. Surface water flow measurement locations and “tape down” locations will be recorded in a field notebook sketch as appropriate.
8. Conduct appropriate decontamination procedures described above.

Standard Operating Procedure F-3

Water Treatment System Monitoring Procedures

This standard operating procedure (SOP) describes the field procedures for collection of in-field water treatment system measurements including grab samples for PCB analysis at the influent, intermediate stage and effluent of the water treatment system, grab samples for TSS at the effluent of the water treatment system and grab samples for phosphorus at the effluent of the water treatment system.

Decontamination Procedures for Sampling Equipment

Proper decontamination of sampling equipment is essential to minimize the possibility of cross-contamination of samples. Nondedicated equipment used for sampling various environmental media (soil, groundwater, surface water, etc.) will be cleaned before its initial use in the field and again before use at each subsequent sampling site.

All nondedicated sampling equipment will be new, or will be decontaminated at RMT prior to its initial use on-site. Decontamination procedures will include the following steps:

1. Wash the equipment in a nonphosphate detergent.
2. Rinse with potable tap water.
3. Rinse with deionized (DI) or distilled water.

Nondedicated equipment that is to be used at additional locations at the site will be field-decontaminated between sampling locations. The field decontamination procedures will be in accordance with the Michigan Department of Environmental Quality (MDEQ) Remediation and Redevelopment Division Operation Memorandum Number 2, Attachment 7 (MDEQ, 2004).

To the extent practicable, single-use sampling equipment and materials will be used for the collection of all environmental samples. The materials used will be new and clean, and will be placed in plastic for transport to the site. Once used, this equipment will be placed in plastic bags and managed as investigation-derived waste material.

Water Treatment System Monitoring Procedures

Grab samples of surface water will be collected at a specified frequency during the response activities for PCB analysis. Surface water samples will be collected from the influent, at the intermediate stage and at the effluent of the water treatment system. Surface water grab samples will be collected at the effluent of the water treatment system for phosphorus and TSS monitoring at a specified frequency during the response activities. Turbidity measurements will also be collected during the water treatment system operation activities. The general procedures to be followed when the surface water grab samples are collected or measurements taken are outlined below. Specific analytical methods are described in the QAPP.

The procedures for collection of water treatment system grab samples are provided below.

1. Record the surface water grab sample location (*i.e.* effluent, influent) on the sample log or in field notebook along with other appropriate information [include a sketch indicating location of sample relative to the water treatment system].
2. Don health and safety equipment (as required by the Multi-Area HSP).
3. Collect the grab samples by quickly immersing the specified sample container with the mouth of the container pointing towards the influent.
4. Raise the sample jar from the water with minimal disturbance and secure the jar.
5. At each station, collect field measurements for temperature, pH, turbidity, conductivity, and DO and record results in the field logbook or Surface Water Sampling Log.
6. Secure all sample jar caps tightly.
7. Label all sample containers.
8. Place filled sample containers on ice in a cooler.
9. Collect field duplicate and matrix spike (MS) and matrix spike duplicate (MSD) samples during each sampling event. Field duplicates and MS/MSD samples will be prepared by filling additional sets of sample containers with water collected at the same time and depth. One additional set of sample containers will be filled for field duplicates and two sets of containers will be filled for MS/MSD samples.
10. Follow procedures for preservation of samples and packing, handling, and shipping with associated chain-of-custody procedures for samples.
11. Follow appropriate decontamination procedures described above.
12. Record required information in the field logbook or Surface Water Sampling Log.

Standard Operating Procedure F-4

Sediment Sampling

This standard operating procedure (SOP) is applicable to the collection of representative sediment samples. The methodologies discussed in this SOP are applicable to the sampling of sediment in both flowing and standing water. They are generic in nature and may be modified in whole or part to meet the handling and analytical requirements of the contaminants of concern, as well as the constraints presented by site conditions and equipment limitations. Modifications of sampling methodologies will be documented in the appropriate field logbook and discussed in reports summarizing field activities and analytical results. For the purposes of this procedure, sediments are those mineral and organic materials situated beneath an aqueous layer.

Method Summary

Sediment samples may be collected using a variety of methods and equipment, depending on the depth of the water, the portion of the sediment profile required (surface vs. subsurface), the type of sample required (disturbed vs. undisturbed), contaminants present, and sediment type. Sediment is collected from beneath the water either directly, using a hand held device such as a shovel, trowel, or auger; or indirectly, using a device such as an Ekman or Ponar dredge. Following collection, sediment is transferred from the sampling device to a sample container of appropriate size and construction for the analyses requested. If composite sampling techniques are employed, multiple grabs are placed into a container constructed of inert material, homogenized, and transferred to sample containers appropriate for the analyses requested.

Equipment/Apparatus

Equipment needed for collection of sediment samples may include:

- Maps/plot plan
- Safety equipment
- Compass
- Tape measure
- Survey stakes, flags, or buoys and anchors
- Camera and film
- Stainless steel, plastic, or other appropriate composition bucket
- 4-oz., 8-oz., and one-quart wide mouth jars w/Teflon lined lids
- Ziploc plastic bags
- Logbook
- Sample jar labels
- Chain of Custody records, field data sheets

- Cooler(s)
- Ice
- Decontamination supplies/equipment
- Spade or shovel
- Spatula
- Scoop
- Trowel
- Bucket auger
- Tube auger
- Extension rods
- "T" handle
- Sediment coring device (tube, suction head, extension rods, "T" handle)
- Ponar dredge
- Ekman dredge
- Nylon rope or steel cable
- Messenger device

Decontamination Procedures

Decontamination Prior to Sampling

Proper decontamination of sampling equipment is essential to minimize the possibility of cross-contamination of samples. Nondedicated equipment used for sampling various environmental media (soil, groundwater, surface water, etc.) will be cleaned before its initial use in the field and again before use at each subsequent sampling site.

All nondedicated sampling equipment will be new, or will be decontaminated at RMT prior to its initial use on-site. Decontamination procedures will include the following steps:

1. Wash the equipment in a nonphosphate detergent.
2. Rinse with potable tap water.
3. Rinse with deionized (DI) or distilled water.

To the extent practicable, single-use sampling equipment and materials will be used for the collection of all environmental samples. The materials used will be new and clean, and will be placed in plastic for transport to the site. Once used, this equipment will be placed in plastic bags and managed as investigation-derived waste material.

In-Field Sampling Decontamination Procedures

As described above, this sampling protocol describes multiple methods for sediment sample collection. The decontamination procedures described below will be relied upon in the field as appropriate for equipment decontamination.

Nondedicated equipment that is to be used at additional locations at the site will be field-decontaminated between sampling locations. Details regarding the decontamination of field equipment is included in the section below. The field decontamination procedures will be in accordance with the Michigan Department of Environmental Quality (MDEQ) Remediation and Redevelopment Division Operation Memorandum Number 2, Attachment 7 (MDEQ, 2004).

The field decontamination of sampling equipment will take place at the sampling location. All decontamination water will be contained in 5-gallon buckets and transported to the decontamination pad for collection with other decontamination wastewater.

The field equipment blanks will be collected in accordance with the sampling methodology specified in Attachment 7 (MDEQ, 2004).

Sample Collection

Selection of a sampling device is most often contingent upon: 1) the depth of water, and 2) the physical characteristics of the sediment to be sampled. The following procedures may be utilized:

Sampling Surface Sediment with a Trowel or Scoop

The sampling method is accomplished by wading into the surface water body and while facing upstream (into the current), scooping the sample along the bottom of the surface water body in the upstream direction. Excess water may be removed from the scoop. However, this may result in the loss of some fine particle size material associated with the bottom of the surface water body.

This method can be used to collect consolidated sediments but is limited somewhat by the depth of water. Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sample team member. In surface water bodies that are too deep to wade, but less than eight feet deep, a stainless steel scoop or spoon attached to a piece of conduit can be used either from the banks if the surface water body is narrow or from a boat. The sediment is placed into a glass pan and homogenized.

A stainless steel scoop or lab spoon will suffice in most applications. Follow these procedures to collect sediment samples with a stainless steel scoop:

1. Using a precleaned stainless steel scoop, remove the desired thickness of sediment from the sampling area.
2. Transfer the sample into an appropriate sample or homogenization container.

Sampling Surface Sediment with a Bucket Auger or Tube Auger

This system consists of an auger, a series of extension rods, and a “T” handle. The auger is driven into the sediment and used to extract a core. A sample of the core is taken from the appropriate depth.

Use the following procedure to collect sediment samples with a thin-walled auger:

1. Insert the auger into the material to be sampled at a 0° to 45° angle from vertical. This orientation minimizes spillage of the sample from the sampler. Extraction of samples may require tilting of the sampler.
2. Rotate the auger once or twice to cut a core of material.
3. Slowly withdraw the auger, making sure that the slot is facing upward.
4. An acetate core may be inserted into the auger prior to sampling, if characteristics of the sediments or body of water warrant. By using this technique, an intact core can be extracted.
5. Transfer the sample into an appropriate sample or homogenization container.

Sampling Surface Sediment with a Ponar Dredge

The Ponar dredge uses a self-tripping sampler featuring hinged jaws and a spring loaded pin that releases when the sampler makes impact with the bottom. The top is covered with a stainless steel screen with neoprene rubber flaps which allows water to flow through for a controlled descent and less interference with the sample.

Follow these procedures for collecting sediment with a Ponar dredge:

1. Attach a sturdy nylon or steel cable to the hook provided on top of the dredge.
2. Arrange the Ponar dredge sampler in the open position, setting the trip bar so the sampler remains open when lifted from the top.
3. Slowly lower the sampler to a point just above the sediment.
4. Drop the sampler sharply into the sediment, then pull sharply up on the line, thus releasing the trip bar and closing the dredge.
5. Raise the sampler to the surface and slowly decant any free liquid through the screens on top of the dredge. Be careful to retain fine sediments.
6. Open the dredge and transfer the sediment to a stainless steel or plastic bucket. Continue to collect additional sediment until sufficient material has been gained. Thoroughly mix sediment to obtain a homogeneous sample, and then transfer to the appropriate sample container.

Sampling Subsurface Sediment with a Coring Device

Core samplers are used to sample vertical columns of sediment. They are particularly useful when a historical picture of sediment deposition is desired since they preserve the sequential layering of the deposit, and when it is desirable to minimize the loss of material at the sediment-water interface.

Follow these procedures when using a sample coring device to collect subsurface sediments. It consists of a coring device, handle, and acetate core barrel:

1. Assemble the coring device by inserting the core into the sampling tube assembly.

2. Insert the “vacuum plug” into the tip of the sampling tube with the wire connected through the top portion of sampling equipment.
3. Tighten the plug so the fit is snug within the tube.
4. Tighten the rubber fitting, associated with the sampling equipment, around the top end of the tube.
5. Screw the handle onto the upper end of the sampling tube and add extension rods as needed.
6. Place the sampler in a perpendicular position on the material to be sampled.
7. With left hand holding the wire (connected to the plug inside the core assembly), place downward pressure on the sampler into the material to the desired depth. Do not allow the plug to proceed deeper (hold left hand at constant elevation, while advancing core with right hand).
8. Place downward pressure on the device until the desired depth is reached.
9. Withdraw the sampler by pulling the sampling assembly upwards, until the bottom of the core can be reached below the surface of the water.
10. Place cap on core, while end of the core is still underneath the water’s surface.
11. Remove core from water and loosen rubber fitting.
12. Remove core from sampling equipment and place an additional cap on top of core (it may be appropriate to reduce the core length prior to capping the core).
13. The sample may be used in this fashion, or the contents transferred to a stainless steel or plastic bucket and mixed thoroughly to obtain a homogeneous sample representative of the entire sampling interval.

Sediment Probing and Bathymetric Survey

The metal calibration rod will be used to probe sediment depths along the sediment characterization transects. From a boat, at each station, the water depth to top of sediment will be measured by probing with a surveyor's rod. The sediment depth will then be measured by pushing a calibrated 5/8-inch galvanized hollow pipe into the sediment until refusal using reasonable human force. The depth of the penetrated sediment will be noted by subtracting the length of the rod above the water surface and the water depth at the point being probed from the length of the entire rod. Measurements made of location, depth, time, and field samples will be noted by subtracting the length of the rod above the water surface and the water depth at the point being probed from the length of the entire rod. Measurements made of location (using a GPS unit, if applicable), depth, time, and field samples will be noted in the field logbook.

References

- Mason, B.J. Preparation of Soil Sampling Protocol: Technique and Strategies. 1983 EPA-600/4-83-020.
- Barth, D.S. and B.J. Mason. Soil Sampling Quality Assurance User's Guide. 1984 EPA-600/4-84-043.
- U.S. EPA. Characterization of Hazardous Waste Sites - A Methods Manual: Volume II. Available Sampling Methods, Second Edition. 1984 EPA Hazardous Waste Streams. 1980 EPA-600/2-80-018.
- Field Sampling Guidance Document #1215 – Sediment Sampling, U.S. EPA Region 9 Laboratory Richmond California. 1999.
- Sediment Sampling SOP #2016. U.S. EPA. 1994.

Standard Operating Procedure F-5

Soil Sampling with Direct Push Sampler

The primary means for the collection of subsurface soil samples will be a direct-push technique using a Geoprobe® or equivalent driver. Direct-push soil samples will be obtained using a closed-piston soil sampler with a liner (or equivalent sampling system). The Sampler will be operated in accordance with the manufacturer's recommended operating procedures for the type of equipment used.

Soil samples will be collected at predetermined intervals based on specific data needs. The samples will be classified in accordance with the Unified Soil Classification System (USCS), and field logs will be prepared. A summary of the USCS is attached to this procedure.

Small subsamples representative of the major soil types will be retained for use in developing visual classification as described later in this subsection, and for physical testing, as required.

Subsamples selected for laboratory analysis will be placed in appropriate sample containers provided by the analytical laboratory, labeled, placed in an iced cooler, and stored in accordance with chain-of-custody requirements specified in the QAPP until shipment to the laboratory (or laboratories) is arranged. Chain-of-Custody Records will be completed for all samples according to the methods described in the QAPP.

Geoprobe® and support equipment will not come in direct contact with the samples, so cross-contamination of samples is not a concern. However, this equipment will likely come in contact with impacted soil and must therefore be decontaminated prior to moving from one location to another.

The Geoprobe® equipment used for soil sampling and monitoring well installation will be cleaned with high-pressure/hot water washing equipment prior to initiating the field investigation. The same procedure will be applied to all drilling equipment between each boring location. The cleaning will occur at a decontamination pad constructed at a suitable location(s) at the site. Water used for cleaning will be obtained from a local potable water source. Equipment subject to these decontamination procedures includes, but is not limited to, the following:

- Direct Push drill rig
- Direct Push sampler components

In addition, downhole equipment that comes in direct contact with samples will be decontaminated between each sample interval. This procedure will include washing with a nonphosphate detergent and rinsing with clean potable water.

A piece of Direct Push equipment that comes in direct contact with soil samples (e.g., split-barrel samplers) will be selected for collection of one field equipment blank. After the equipment has been

cleaned, it will be rinsed with DI water. The rinse water will be collected and submitted for analysis of all constituents for which the normal samples collected with the equipment are being analyzed.

Appendix B

Example Forms/Logs

Appendix C

QAPP Worksheets
